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- | | | | | |
|-----------|-----|---------|------------------|--------------------------|
| 5,064,097 | A * | 11/1991 | Brog et al. | 222/129 |
| 5,129,549 | A * | 7/1992 | Austin | B67D 1/0085
222/129.1 |
| 5,245,914 | A | 9/1993 | Vitous | |
| 5,285,718 | A | 2/1994 | Webster et al. | |
| 5,299,715 | A * | 4/1994 | Feldman | B67D 1/1243
222/129.1 |
| 5,312,020 | A | 5/1994 | Frei | |
| 5,724,883 | A | 3/1998 | Usherovich | |
| 5,845,815 | A * | 12/1998 | Vogel | B67D 1/12
137/504 |
| 5,875,930 | A | 3/1999 | Nakajima et al. | |

(Continued)

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FOREIGN PATENT DOCUMENTS

- | | | | |
|----|-----------|---|---------|
| CN | 2305134 | Y | 1/1999 |
| CN | 101091622 | A | 12/2007 |

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(Continued)

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OTHER PUBLICATIONS

PCT/US2011/060749 International Search Report dated Jan. 16, 2012.

(Continued)

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 CPC . *A47J 31/41* (2013.01); *A47J 31/56* (2013.01)
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 USPC 222/129.1, 129.3, 129.4, 144.5, 146.1,
 222/64, 65
 See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

- | | | | | |
|-----------|-----|---------|------------------------|-----------|
| 4,068,781 | A | 1/1978 | Toth | |
| 4,211,342 | A * | 7/1980 | Jamgochian et al. | 222/129.4 |
| 4,649,809 | A | 3/1987 | Kanezashi | |
| 4,792,059 | A * | 12/1988 | Kerner et al. | 222/67 |
| 4,903,862 | A | 2/1990 | Shannon et al. | |

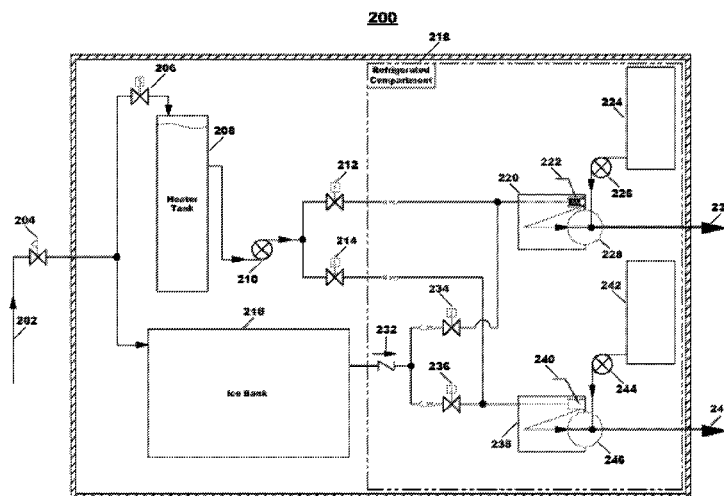
(57) **ABSTRACT**

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An apparatus and method may be configured for detecting selection between a hot version and a cold version of a beverage, causing opening of a first of a plurality of valves and closing of a second of the plurality of valves for providing water to a first of a plurality of mixing chambers based on the selection, causing delivery of beverage concentrate to the first mixing chamber, controlling a flow rate of the water and a flow rate of the beverage concentrate into the mixing chamber for mixing of the water with the beverage concentrate in a controlled ratio to create the beverage, and dispensing the beverage from the mixing chamber.

9 Claims, 6 Drawing Sheets



(56)

References Cited**U.S. PATENT DOCUMENTS**

5,975,365 A 11/1999 Hsieh
 6,003,733 A 12/1999 Wheeler
 6,016,935 A 1/2000 Huegerich et al.
 6,142,063 A 11/2000 Beaulieu et al.
 6,182,555 B1 2/2001 Scheer et al.
 6,192,785 B1 2/2001 Trida et al.
 6,220,047 B1 4/2001 Vogel et al.
 6,240,829 B1 6/2001 McGarrah
 6,460,735 B1 10/2002 Greenwald et al.
 6,522,834 B1 2/2003 Herrick et al.
 6,532,749 B2 3/2003 Rudick et al.
 6,669,053 B1 12/2003 Garson et al.
 6,685,059 B2 2/2004 Jones et al.
 6,772,919 B2 8/2004 Magri
 6,915,732 B2 7/2005 Jones et al.
 6,915,926 B2 7/2005 Naik
 6,938,801 B1 9/2005 Reddy et al.
 7,051,646 B2 5/2006 Della Pietra et al.
 7,147,131 B2 12/2006 Sher et al.
 7,231,142 B1 6/2007 Leung et al.
 7,337,624 B2 3/2008 Franck et al.
 7,347,345 B2 3/2008 Guerrero et al.
 7,592,084 B2 9/2009 Hoffjann et al.
 7,654,191 B2 * 2/2010 Greenwald et al. 99/275
 7,661,352 B2 2/2010 Sher et al.
 7,976,883 B2 7/2011 Guerrero et al.
 8,387,828 B2 * 3/2013 Moothart 222/130
 2003/0101735 A1 6/2003 Teague et al.
 2004/0026452 A1 2/2004 Santiago et al.
 2004/0206244 A1 10/2004 Spiegel et al.

2005/0236431 A1 10/2005 Rahn
 2005/0238768 A1 10/2005 Sher et al.
 2006/0006195 A1 1/2006 Jones et al.
 2006/0115572 A1 6/2006 Guerrero et al.
 2006/0158240 A1 7/2006 Gondhalekar et al.
 2007/0051248 A1 3/2007 Lee et al.
 2007/0080169 A1 4/2007 Sher et al.
 2008/0020115 A1 1/2008 Guerrero et al.
 2008/0282897 A1 11/2008 Webster et al.
 2009/0057340 A1 3/2009 Moothart
 2009/0095163 A1 4/2009 Sala et al.
 2009/0118668 A1 * 5/2009 Bixby 604/77
 2009/0166377 A1 * 7/2009 Piatnik B67D 1/0051
 222/1
 2010/0116842 A1 * 5/2010 Hecht et al. 222/1
 2011/0259472 A1 10/2011 Clark et al.

FOREIGN PATENT DOCUMENTS

JP H81996-34493 2/1996
 JP H81996-156997 6/1996
 JP 3056263 11/1998
 RU 2380020 C2 1/2010
 WO 00/47058 8/2000
 WO 2006058713 A1 6/2006
 WO 2008/007278 1/2008
 WO 2010037806 A1 4/2010

OTHER PUBLICATIONS

UF-1 and UFB-1 Valves Training Manual, copyright 1999-2005, IMI
 Cornelius, Inc., pp. 5-6.

* cited by examiner

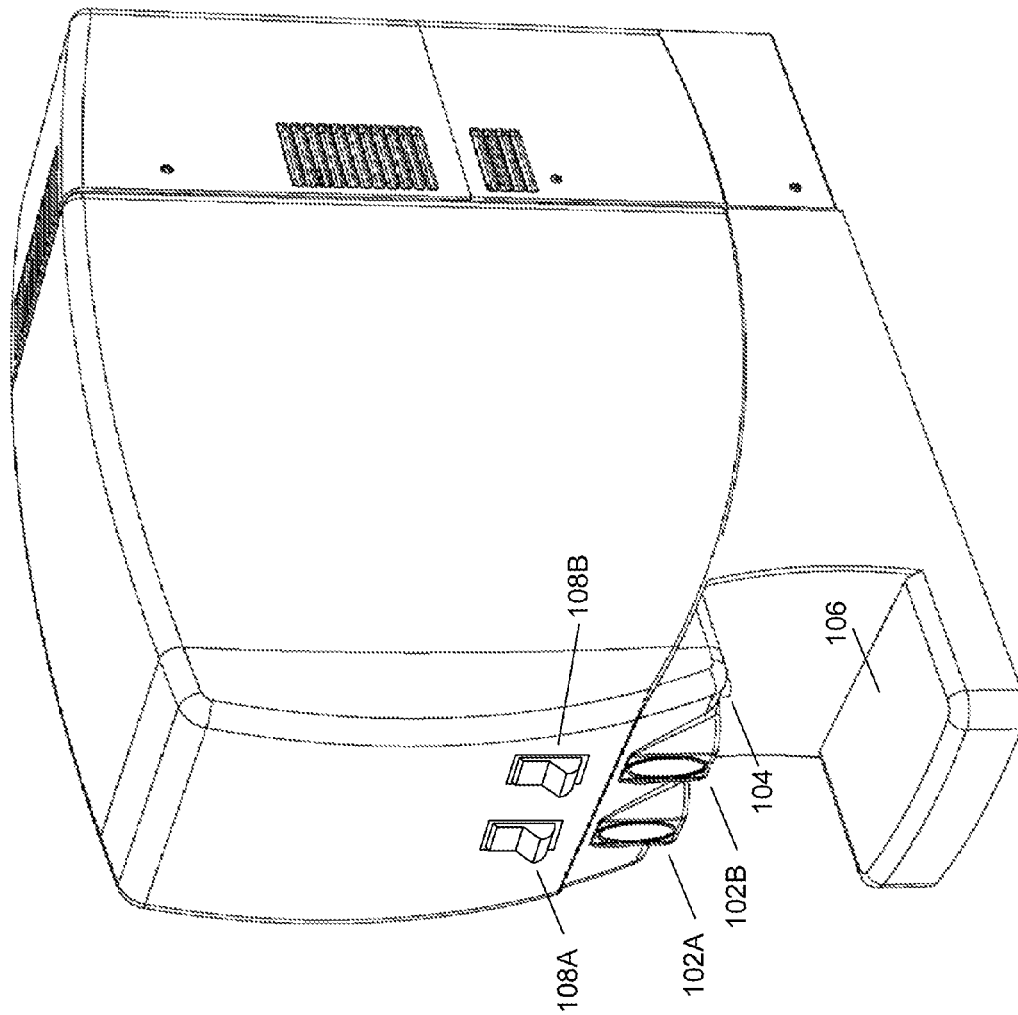


FIG. 1

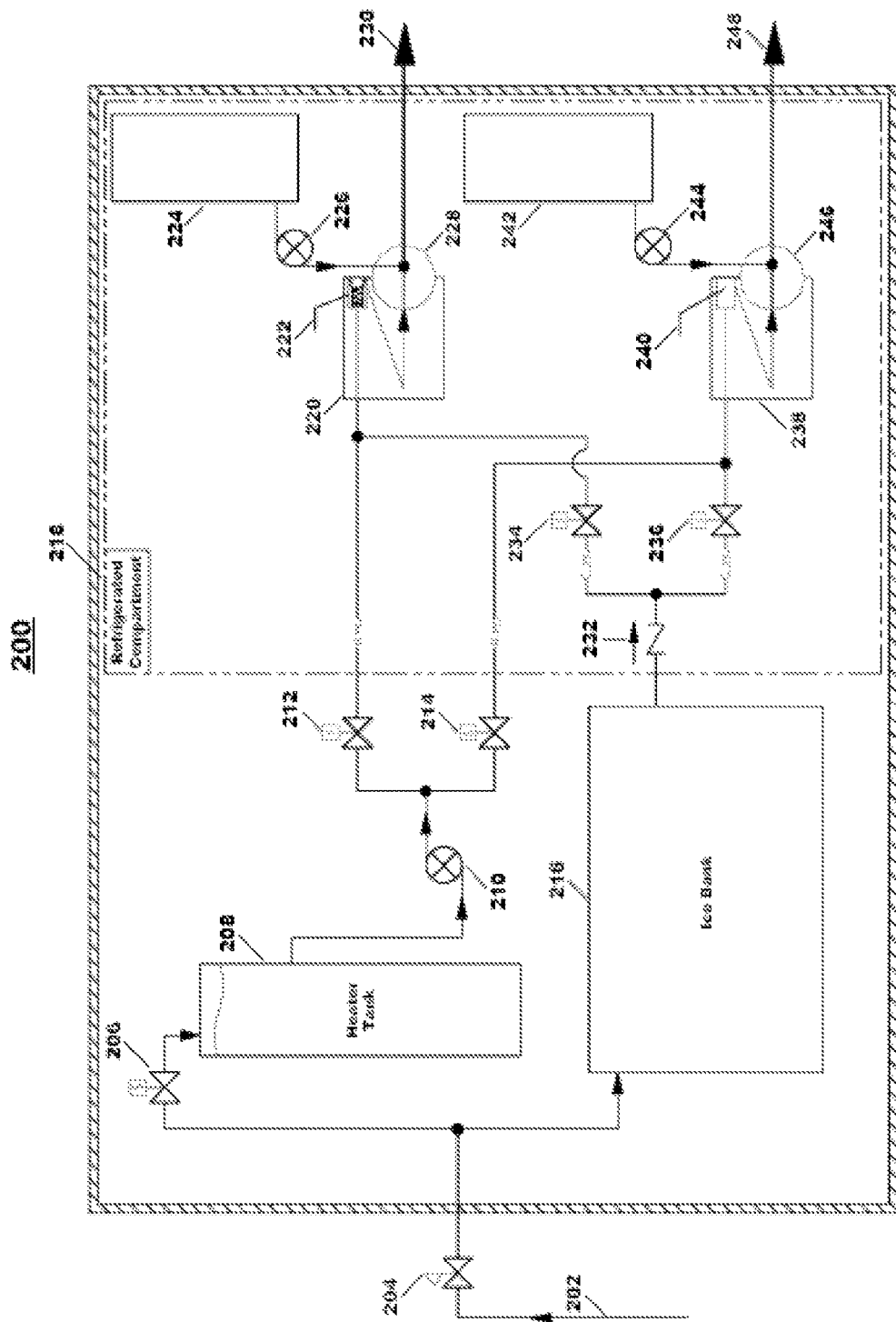


FIG. 2

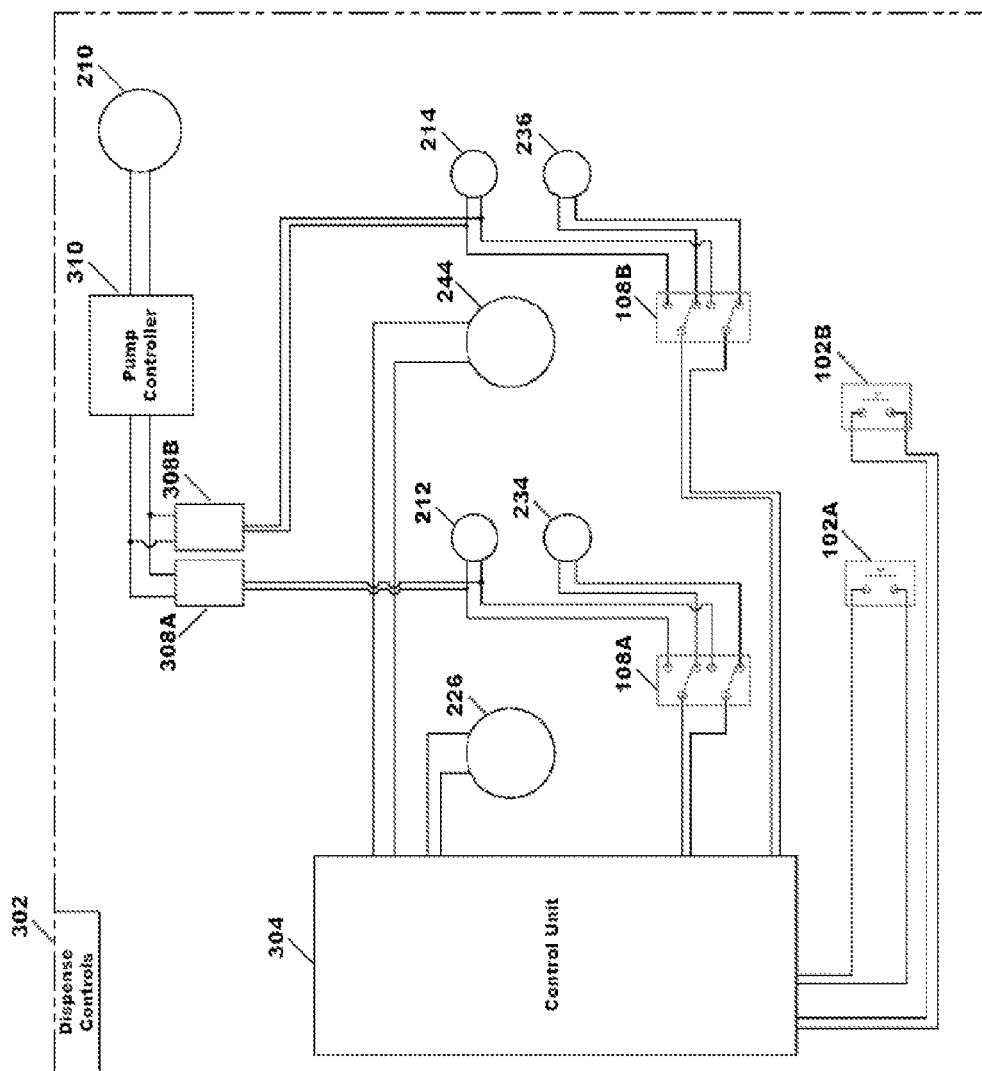


FIG. 3

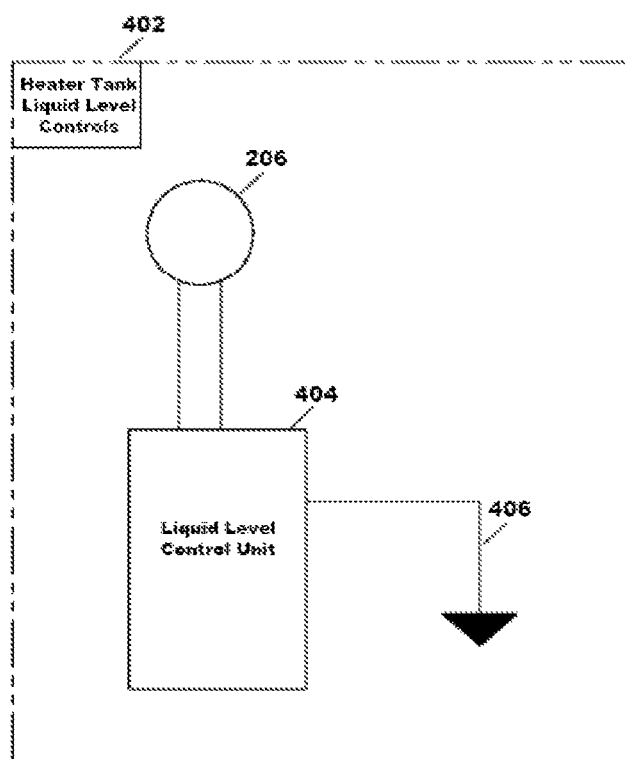


FIG. 4

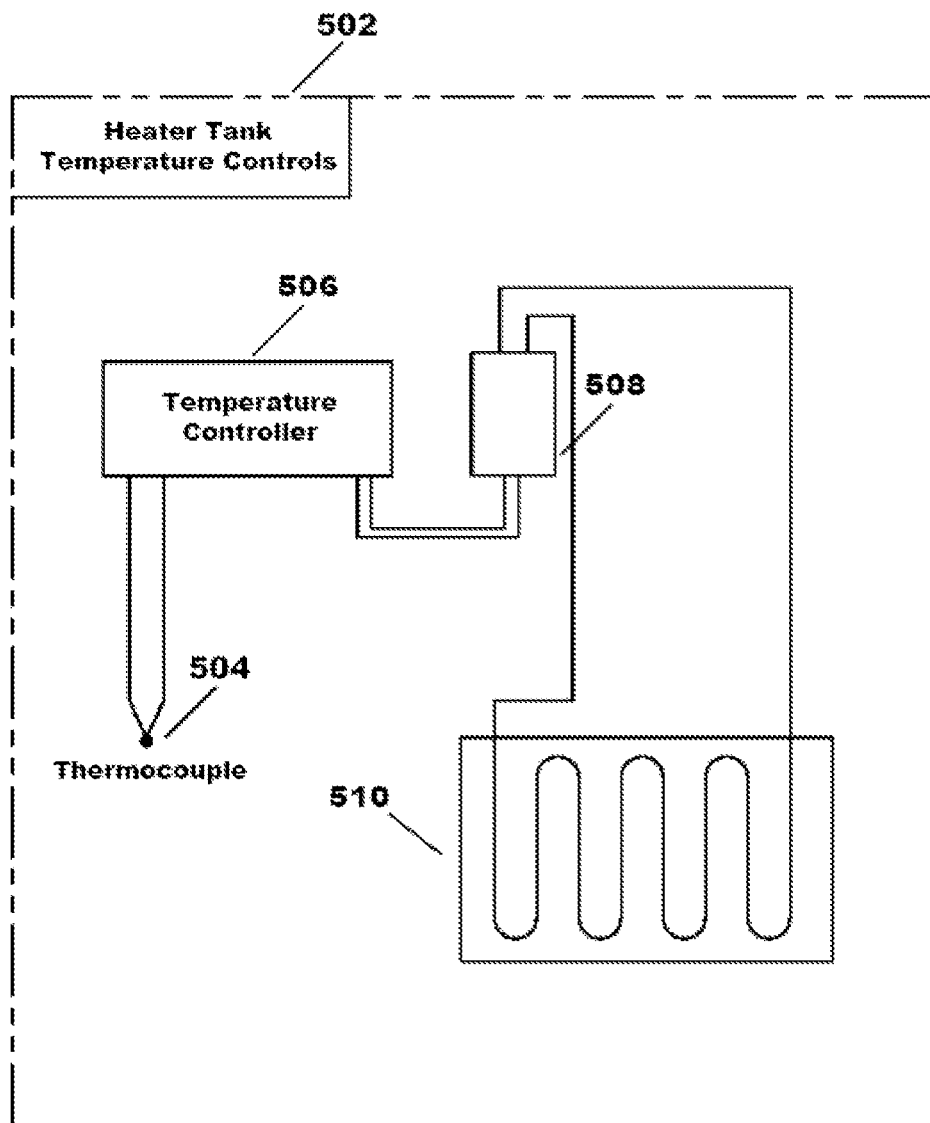


FIG. 5

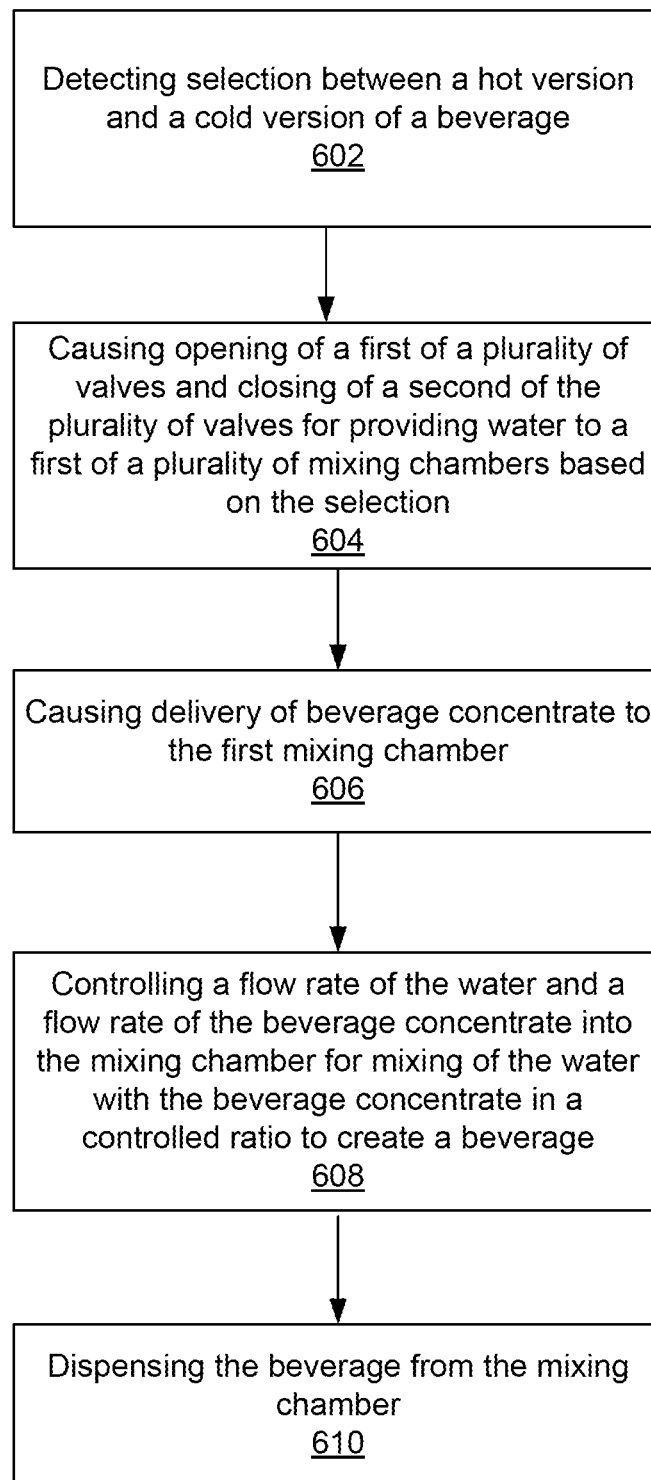


FIG. 6

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HOT AND COLD BEVERAGE DISPENSER**BACKGROUND INFORMATION**

While cold beverage products are very popular, consumers are drinking an increasing number of hot beverages, especially non-carbonated beverages. Existing post-mix beverage dispensing equipment, however, cannot make both hot and cold drinks. Conventionally, a post-mix dispenser receives a concentrated beverage ingredient (e.g., syrup) in a container (e.g., bag-in-box) and mixes the concentrate with cold water to produce a cold beverage upon demand.

BRIEF SUMMARY

The following presents a simplified summary in order to provide a basic understanding of some aspects of the disclosure. The summary is not an extensive overview. It is neither intended to identify key or critical elements nor to delineate the scope of the disclosure. The following summary merely presents some concepts in a simplified form as a prelude to the more detailed description below.

An apparatus and method may be configured for detecting selection between a hot version and a cold version of a beverage, causing opening of a first of a plurality of valves and closing of a second of the plurality of valves for providing water to a first of a plurality of mixing chambers based on the selection, causing delivery of beverage concentrate to the first mixing chamber, controlling a flow rate of the water and a flow rate of the beverage concentrate into the mixing chamber for mixing of the water with the beverage concentrate in a controlled ratio to create the beverage, and dispensing the beverage from the mixing chamber.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the present disclosure and the advantages thereof may be acquired by referring to the following description in consideration of the accompanying drawings, in which like reference numbers indicate like features, and wherein:

FIG. 1 illustrates an example embodiment of a beverage dispenser that can produce hot and cold versions of a same beverage using post-mix dispensing technology.

FIG. 2 illustrates an example plumbing system for a beverage dispenser.

FIGS. 3-5 illustrate example control systems configured to control components depicted in the plumbing system.

FIG. 6 illustrates an example flow diagram of a method for creating a hot or cold version of a beverage.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

In the following description of the various embodiments, reference is made to the accompanying drawings, which form a part hereof, and in which is shown by way of illustration various embodiments in which the invention may be practiced. It is to be understood that other embodiments may be utilized and structural and functional modifications may be made without departing from the scope and spirit of the present invention.

FIG. 1 illustrates an example embodiment of a beverage dispenser **100** that can produce hot and cold versions of a same beverage using post-mix dispensing technology. The beverage dispenser **100** may include a dispense switch **102**, an output nozzle **104**, and a temperature selector switch **108**.

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When a beverage is desired, a user may place a cup on base surface **106** underneath a nozzle **104** corresponding to the dispense switch **102** to be actuated. The user may then select a desired temperature (e.g., hot, cold, etc.) for the beverage using the temperature selector switch **108**, and may actuate the dispense switch **102** to cause the beverage dispenser **100** to create and output the beverage into the cup. The temperature selector switch **108** may be a rocker switch as shown, or may be a dial or other type of indicator permitting a user to select a desired beverage temperature. Each dispense switch **102** may have a corresponding nozzle **104** for dispensing a beverage. The beverage dispenser **100** may dispense a different flavored beverage at each nozzle **104** or multiple nozzles **104** may output the same flavored beverage. The beverage dispenser **100** may be of other shapes and sizes than the one shown in FIG. 1, and may include more or fewer dispense switches **102**. Advantageously, the beverage dispenser **100** may have a lower equipment cost, require less space, and increase product variety by offering hot and cold versions of each beverage.

FIG. 2 illustrates an example plumbing system **200** for the beverage dispenser **100**, and FIGS. 3-5 illustrate example control systems configured to control components depicted in the plumbing system. The depicted plumbing system **200** may create and dispense beverages at outlets **230**, **248** that lead to a respective nozzle. The dispensed beverages may have the same or different flavors. The plumbing system **200** may also produce hot and cold versions of each beverage. The plumbing system **200**, however, is an example, and can be extended to include more than two outlets and up to as many different beverage flavors as outlets.

Starting on the left, the plumbing system **200** may include a water inlet **202** to receive water (e.g., tap water, filtered water, etc.) from a water source. The water inlet **202** may be coupled to a water pressure regulator **204** that controls water pressure supplied to a fill solenoid valve **206** and to ice bank **216**. The fill solenoid valve **206** may be associated with a level detector that determines a level of hot water contained in a heater tank **208**. Hot water also may be supplied by an inline heater, hot incoming water, or other manners for providing hot water. Based on the detected level of hot water, the level detector may cause the fill solenoid valve **206** to open to permit water to enter the tank **208** when below a minimum level and to close to stop water from entering the tank **208** when the water has reached a maximum level. A gear pump **210** coupled to the heater tank **208** may control dispensing of the hot water. Also, other water driving mechanisms, such as gravity driven systems or air pumps may also control dispensing of the hot water. The water pressure regulator **204** may control the pressure of water supplied to the ice bank **216** for chilling until being dispensed. A one-way check valve **232** permits cold water to flow out of the ice bank **216** but prevents water from flowing back into the ice bank **216**.

A series of solenoid valves **212**, **214**, **234**, and **236** may control flow of water from either the heater tank **208** or the ice bank **216** to respective mixing apparatuses **220**, **238**. User selection of a beverage having a particular flavor and a hot or cold version of the beverage controls which of the solenoid valves **212**, **214**, **234**, and **236** are open and which are closed. If a single beverage is being dispensed at a particular instant, one of the solenoid valves **212**, **214**, **234**, and **236** may be open while the rest may be closed. If simultaneously dispensing multiple beverages from two or more nozzles **104**, the beverage dispenser **100** may control the solenoid valves **212**, **214**, **234**, and **236** to supply one of hot or cold water to the mixing chambers corresponding to the two or more nozzles **104**. In response to selection of a hot version, hot water

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solenoid valves **212** and **214** direct hot water to a particular mixing apparatus **220** or **238** based on which beverage a user has selected for dispensing. In response to selection of a cold version, cold water solenoid valves **234** and **236** are used to direct cold water to a particular mixing apparatus **220** or **238** based on which beverage a user has selected for dispensing.

Each of the mixing apparatuses **220**, **238** may mix either the hot or cold water with a beverage concentrate to create a beverage. Each mixing apparatus **220**, **238** may include a flow control **222**, **240** to control the amount of water provided to the mixing chambers **228**, **246** and the concentrate pumps **226**, **244** may control the amount of beverage concentrate provided to the mixing chamber **228** to control the water to concentrate ratio (e.g., 2 parts water, 1 concentrate (2:1), 3:1, etc.) of the beverage. The concentrate pumps **226**, **244** may be, for example, peristaltic pumps. Also, other concentrate driving mechanisms, such as gravity driven systems or water driven systems may also control dispensing of the beverage concentrate.

The flow controls **222**, **240** may be electronic or mechanical controllers that detect a flow rate of water and a flow rate of beverage concentrate supplied to the mixing apparatus **220**, **238**. Based on detected flow rates, the flow controls **222**, **240** may adjust a size of orifices that supply water and beverage concentrate to the mixing chambers **228**, **246**. The orifices may be located at different locations along a water flow path between the solenoid valves **212**, **214**, **234**, and **236** and the mixing chambers **228**, **246**, as well as at different locations between the pumps **226**, **244** and the mixing chambers **228**, **246**.

In an example, the flow control **222** may electrically or mechanically control the size of an orifice in the water flow path or the concentrate flow path. The flow control **222** may determine that the concentrate flow rate exceeds a threshold and cause a decrease in the size of an orifice to reduce the amount of beverage concentrate flowing into the mixing chamber **228**. The flow control **222** may also make similar adjustments of the water flow rate based on comparison with a threshold. The flow control **222** may also control a water orifice size based on beverage concentrate flow rate and a beverage concentrate orifice size based on water flow rate.

To adjust the size of the orifice, the flow control **222** may electrically or mechanically adjust the location of a piston relative to a sleeve. Moving a piston into a sleeve may obstruct and thereby reduce the size of the orifice to reduce a flow rate, and moving the piston out of the sleeve may further open and thereby increase the size of the orifice to increase a flow rate. For example, the flow control **240** may determine that a water pressure can only supply water at a certain flow rate, and may send an electrical signal to cause a piston in the concentrate flow path to near a sleeve to reduce the size of a beverage concentrate orifice to reduce the amount of beverage concentrate supplied to the mixing chamber **246**.

In an example using mechanical control, the flow control **222** may include two ceramic flow controllers, a first being positioned in the water path and a second in the beverage concentrate path. Each ceramic flow controller may have a sleeve and a piston. Fluid pressure adjusts a location of the piston relative to the sleeve thereby controlling a size of an outlet orifice by adjusting the amount of fluid that can pass through the ceramic flow controller. Greater fluid pressure at one end of the piston causes the other end to enter the sleeve to reduce the size of the orifice, whereas lower pressure may cause the piston to back out of the sleeve thereby increasing the size of the orifice. The flow controls **222**, **240** are optional and may also be omitted. Other types of flow control may also be used, such as a UF-1 or UFB-1 Valve by IMI Cornelius,

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Inc., described in the "UF-1 and UFB-1 Valves Training Manual," the contents of which are incorporated herein by reference in their entirety.

One or more concentrate containers **224**, **242** with beverage concentrate may be housed within a refrigerated compartment **218** for storage at a desired temperature to lengthen shelf-life. The concentrate containers **224**, **242** may also be stored outside of the beverage dispenser **100** at ambient temperatures. A concentrate container may be a bag-in-box container or other suitable container for storing a beverage concentrate until mixed with water. Each concentrate container **224**, **242** may store the same beverage concentrate or may store two or more different flavors of beverage concentrate. In FIG. 2, only concentrate containers **224**, **242** are depicted, but there may be as many concentrate containers as there are mixing apparatuses. Also, a single concentrate container may provide beverage concentrate to multiple mixing apparatuses, and, in such a scenario, multiple outlets may dispense a hot or cold version of the same flavored beverage. Each concentrate container **224**, **242** may be associated with a concentrate pump **226**, **244** to provide the beverage concentrate to either mixing chamber **228** or **246**.

When a user desires a hot beverage, the gear pump **210** may pump hot water from the heater tank **208** to hot water solenoid valves **212** and **214** that control which one of the mixing chambers **228**, **246** receives the hot water. The number of hot water solenoid valves and the number of cold water valves may correspond to the number of mixing apparatuses. If multiple hot beverages are being simultaneously dispensed at different nozzles, two or more hot water solenoid valves may open at the same time to direct hot water to each mixing apparatus for outputting a beverage at a respective nozzle. If hot and cold beverages are being simultaneously dispensed at different nozzles, multiple solenoid valves may open at the same time, providing one of hot and cold water to each of the mixing apparatuses for outputting a beverage at the respective nozzle.

If hot water solenoid valve **212** is open, then hot water may flow to the mixing apparatus **220**. The other hot and cold water solenoid valves may be closed if no other beverages are being simultaneously dispensed. For example, cold water solenoid valves **234**, **236** may remain closed to prevent cold water from entering the mixing chambers **228**, **246** in response to selection of hot version. The mixing apparatus **220** may also receive the beverage concentrate, supplied by a concentrate pump **226**, for mixing with the hot water in the mixing chamber **228** to create a hot beverage. The flow controller **222** may control the ratio of hot water to beverage concentrate supplied to the mixing chamber **228**. The mixing chamber **228** may receive the ratio of water to concentrate for mixing to create a beverage and then output the hot beverage through outlet **230** to nozzle **104** for dispensing in a cup.

If hot water solenoid valve **214** is open, then hot water may flow to mixing apparatus **238**. The other hot and cold water solenoid valves may be closed if no other beverages are being simultaneously dispensed. The mixing apparatus **238** may also receive beverage concentrate, supplied by a concentrate pump **244**, for mixing with the hot water in a mixing chamber **246** to create a hot beverage. A flow control **240** and the concentrate pump **244** may control the water to concentrate ratio (e.g., 2 parts water, 1 concentrate (2:1), 3:1, etc.) of the beverage. The mixing chamber **246** may then output the hot beverage through outlet **248** to nozzle **104** for dispensing in a cup.

When a user desires a cold beverage at a particular nozzle, the beverage dispenser **100** may open one of the cold water solenoid valves **234**, **236** corresponding to the nozzle for

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supplying cold water from the ice bank 216. Also, the gear pump 210 as well as the hot water solenoid valves 212, 214 may remain closed to prevent hot water from entering the mixing chambers 228, 246 if only a single cold beverage is being dispensed.

If cold water solenoid valve 234 is open, then cold water may flow to mixing apparatus 220. The other hot and cold water solenoid valves may be closed if no other beverages are being simultaneously dispensed. The mixing apparatus 220 may also receive beverage concentrate, supplied by a concentrate pump 226, for mixing with the cold water in a mixing chamber 228 to create a cold beverage. The flow control 222 and the concentrate pump 226 may control the water to concentrate ratio (e.g., 2 parts water, 1 part concentrate (2:1), 3:1, etc.) of the beverage. The mixing chamber 228 may then output the cold beverage through outlet 230 to nozzle 104 for dispensing in a cup.

If cold water solenoid valve 236 is open and no other beverage is being dispensed simultaneously, then the other hot and cold water solenoid valves may be closed and cold water may flow to mixing apparatus 238. The mixing apparatus 238 may also receive beverage concentrate supplied by a concentrate pump 244 for mixing with the cold water in a mixing chamber 246 to create a cold beverage. The flow control 240 and the concentrate pump 244 may control the water to concentrate ratio (e.g., 2:1, 3:1, etc.) of the beverage. The mixing chamber 246 may then output the cold beverage through outlet 248 to nozzle 104 for dispensing in a cup.

Thus, the mixing apparatus 220 may make either a hot or cold version of the same beverage due to the same beverage concentrate being provided from concentrate container 224 for mixing with either hot or cold water. Similarly, the mixing apparatus 238 may make either a hot or cold version of the same beverage due to the same beverage concentrate being provided from concentrate container 242 for mixing with hot or cold water.

The beverage dispenser 100 may simultaneously output beverages at different nozzles 104. In response to user input, the beverage dispenser 100 may control the hot water solenoid valves 212, 214 and the cold water solenoid valve 234, 236 to supply one of hot and cold water to each of the mixing apparatuses 220, 238. For example, the beverage dispenser 100 may simultaneously dispense hot and cold beverages at different nozzles. The beverage dispenser 100 may cause hot water solenoid valve 212 to open and cold water solenoid valve 234 to close, thereby supplying hot water to the mixing apparatus 220 to prepare a hot beverage for outputting at a first nozzle. At about the same time, the beverage dispenser 100 may cause hot water solenoid valve 214 to close and cold water solenoid valve 236 to open, thereby supplying cold water to the mixing apparatus 238 to prepare a cold beverage for outputting at a second nozzle. The beverage dispenser 100 may simultaneously prepare multiple hot beverages, multiple cold beverages, or multiple hot and cold beverages.

The beverage dispenser 100 may also blend hot and cold water to produce a beverage at a desired temperature that is less than a temperature of the hot water and greater than a temperature of the cold water. In this example, both of hot and cold solenoid valves may at least partially open to control an amount of hot and cold water supplied to a particular mixing chamber. For example, the beverage dispenser 100 may simultaneously open the hot water solenoid valve 212 and cold water solenoid valve 234 to provide hot water from the heater tank 208 and cold water from the ice bank 216. The hot and cold water streams may mix prior to reaching the mixing chamber 228, or may be delivered separately to the mixing chamber for mixing therein. The hot and cold solenoid valves

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may also partially open depending on the desired beverage temperature. If a warmer beverage is desired, the beverage dispenser 100 may cause the hot water solenoid valve 212 to open a larger amount and the cold water solenoid valve 234 to open a lesser amount, controlled by how close the desired temperature is to the temperature of the hot water. Conversely, if a cooler beverage is desired, the beverage dispenser 100 may cause the cold water solenoid valve 234 to open a larger amount and the hot water solenoid valve 212 to open a lesser amount. In addition to or instead of the rocker switch 108 shown in FIG. 1, the beverage dispenser 100 may include a temperature dial or other user input device permitting selection of a desired temperature intermediate of the temperature of the hot water and of the cold water. The beverage dispenser 100 may control how open each of the hot and cold water valves are in accordance with the selected temperature.

FIG. 3 illustrates an example dispense control system 302 for controlling dispensing of hot and cold versions of the same beverage by the plumbing system 200. The dispense control system 302 may include a control unit 304 that controls operation of the gear pump 210, the hot water solenoids 212, 214, and the cold water solenoid valves 234, 236, in response to inputs received at temperature selector switches 108A-B and dispense switches 102A-B. The control unit 304 may be a microcontroller or other electrical or electromechanical device that electrically communicates with the other components in the dispense control system 302. The temperature selector switch 108A may control a temperature of a first beverage dispensed in response to actuation of dispense switch 102A, and temperature selector switch 108B may control a temperature of a second beverage dispensed in response to actuation of dispense switch 102B. The first and second beverages may have the same or different flavor depending on the contents of the beverage concentrate included in the concentrate containers 224, 242. The temperature selector switch 108B may be an electromechanical switch that closes a circuit based on which of a hot or cold version is selected, and remains open if the other is selected. The dispense switch 102 may be an electromechanical switch that closes a circuit in response to user actuation and remains open when no longer actuated.

To produce a hot version of the first beverage, the control unit 304 may receive input selecting hot at a temperature selector 108A and may detect actuation of a dispense switch 102A. The control unit 304 may then send an electrical signal to relay 308A to cause a pulse width modulation (PWM) controller 310 to send an electrical signal to gear pump 210 to supply hot water from the heater tank 208. The control unit 304 may also send an electrical signal to hot water solenoid valve 212 to open and to the remaining solenoid valves 214, 234, and 236 to close, if no other beverages are being prepared simultaneously. The control unit 304 may also communicate an electrical signal to the flow control 222 to control a water flow rate and to the concentrate pump 226 to control a beverage concentrate flow rate to control a water to concentrate ratio provided to the mixing chamber 228 for creating a hot beverage.

To produce a cold version of the first beverage, the control unit 304 may receive input selecting cold at a temperature selector 108A (e.g., closing a second of two circuits) and may detect actuation of a dispense switch 102A. The control unit 304 may then send an electrical signal to open the cold water solenoid valve 234 and to close the remaining solenoid valves 212, 214, and 236, if no other beverages are being prepared simultaneously. The control unit 304 may also communicate an electrical signal to the flow control 222 to control a water flow rate and to the concentrate pump 226 to control a bev-

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erage concentrate flow rate to control a water to concentrate ratio provided to the mixing chamber 228 for creating a cold beverage.

To produce a hot version of the second beverage, the control unit 304 may receive input selecting hot at a temperature selector switch 108B and may detect actuation of a dispense switch 102B. The control unit 304 may then send a signal to relay 308B to cause a pulse width modulation (PWM) controller 310 to send an electrical signal to gear pump 210 to supply hot water from the heater tank 208. The control unit 304 may also send a signal to hot water solenoid valve 214 to open and to the remaining solenoid valves 212, 234, and 236 to close, if no other beverages are being prepared simultaneously. The control unit 304 may also communicate an electrical signal to the flow control 240 to control a water flow rate and to the concentrate pump 244 to control a beverage concentrate flow rate to control a water to concentrate ratio provided to the mixing chamber 246 for creating a hot beverage.

To produce a cold version of the second beverage, the control unit 304 may receive input selecting cold at a temperature selector switch 108B and may detect actuation of a dispense switch 102B. The control unit 304 may then send an electrical signal to open the cold water solenoid valve 236 and to close the remaining solenoid valves 212, 214, and 234, if no other beverages are being prepared simultaneously. The control unit 304 may also communicate an electrical signal to the flow control 240 to control a water flow rate and to the concentrate pump 244 to control a beverage concentrate flow rate to control a water to concentrate ratio provided to the mixing chamber 246 for creating a cold beverage. If multiple beverages are being prepared simultaneously, the control unit 304 may operate as above to cause hot or cold water to be sent to each of multiple mixing apparatuses (e.g., hot water to mixing apparatus 220, cold water to mixing apparatus 238).

FIG. 4 illustrates an example heater tank liquid level control system 402 for controlling supply of water to the heater tank 208. The heater tank liquid level control system 402 may include a liquid level control unit 404 and a water level probe 406 to control the fill solenoid valve 206 (see also FIG. 2). The liquid level control unit 404 may be a microcontroller or other electrical or electromechanical device that electrically communicates with the other components in the heater tank liquid level control system 402. The water level probe 406 may communicate an electrical signal indicative of a level of water in the heater tank 208 to the liquid level control unit 404. If the water level is below a minimum level, the liquid level control unit 404 may communicate an electrical signal to cause the fill solenoid valve 206 to open to increase the water level in the heater tank 208 and to close when the water level increases to a predetermined maximum level.

FIG. 5 illustrates an example heater tank temperature control system for controlling a temperature of hot water stored in the heater tank 208. The heater tank temperature control system 502 may include a thermocouple 504, a temperature controller 506, a relay 508, and a heater coil 510 or other heating element. The temperature controller 506 may be a microcontroller or other electrical or electromechanical device that electrically communicates with the other components in the heater tank temperature control system 502. The thermocouple 504 may communicate an electrical signal indicative of a temperature of water in the heater tank 208 to the temperature controller 506. If the temperature is above a predetermined maximum temperature, the temperature controller 506 may communicate an electrical signal to cause the heater coil 510 to turn off to stop heating water in the heater tank 208. If the temperature is below a predetermined minimum temperature, the temperature controller 506 may com-

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municate an electrical signal to cause the heater coil 510 to turn on to start heating water in the heater tank 208.

FIG. 6 illustrates an example flow diagram of a method for creating a hot or cold version of a beverage. The method may be implemented by the beverage dispenser depicted in FIG. 1, its plumbing system 200 shown in FIG. 2, and its control systems depicted in FIGS. 3-5. The method may begin at block 602. In block 602, the method may include detecting, by a control unit, selection between a hot version and a cold version of a beverage. In block 604, the method may include causing opening of a first of a plurality of valves and closing of a second of the plurality of valves for providing water to a first of a plurality of mixing chambers based on the selection. In block 606, the method may include causing delivery of beverage concentrate to the first mixing chamber. In block 608, the method may include controlling a flow rate of the water and a flow rate of the beverage concentrate into the mixing chamber for mixing of the water with the beverage concentrate in a controlled ratio to create the beverage. In block 610, the method may include dispensing the beverage from the mixing chamber.

The components of one or more of the example embodiments may be embodied in computer-executable instructions, such as in one or more program modules, executed by one or more computers or other devices. Generally, program modules include routines, programs, objects, components, data structures, etc. that perform particular tasks or implement particular abstract data types when executed by a processor in a computer or other device. The computer executable instructions may be stored on a computer readable medium such as a hard disk, optical disk, removable storage media, solid state memory, RAM, etc. As will be appreciated by one of skill in the art, the functionality of the program modules may be combined or distributed as desired in various embodiments. In addition, the functionality may be embodied in whole or in part in firmware or hardware equivalents such as integrated circuits, field programmable gate arrays (FPGA), application specific integrated circuits (ASIC), and the like.

Embodiments include any novel feature or combination of features disclosed herein either explicitly or any generalization thereof. While embodiments have been described with respect to specific examples including presently preferred modes of carrying out the example embodiments, those skilled in the art will appreciate that there are numerous variations and permutations of the above described systems and techniques.

We claim:

1. An apparatus comprising:

- a hot water valve configured to control supplying of hot water from a heater tank configured to store hot water, the heater tank comprising a liquid level control unit configured to monitor a level of the hot water in the heater tank and to cause input of water into the heater tank in response to the level falling below a predetermined level;
- a cold water valve configured to control supplying of cold water;
- a first dispense switch corresponding to a first beverage;
- a second dispense switch corresponding to a second beverage;
- a temperature indicating selector switch configured to receive input selecting between a hot version and a cold version of a beverage, the temperature indicating selector switch further configured to indicate between the hot or cold selection;
- a pump, the pump coupled to a first concentrate container configured to store a first beverage concentrate and

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coupled to a second concentrate container configured to store a second beverage concentrate different from the first beverage concentrate;

a first and second mixing chamber coupled to the pump, the hot water valve, and the cold water valve,

at least one flow controller configured to detect a flow of water and beverage concentrate;

wherein the apparatus is configured to cause the hot water valve to open to supply the hot water and the pump to supply one of the first beverage concentrate or second beverage concentrate to one of the first or second mixing chamber creating the hot version of a corresponding beverage in response to the input being a selection of the hot version and one of the first dispense switch or second dispense switch being actuated,

wherein the apparatus is configured to cause the cold water valve to open to supply the cold water and the pump to supply the other of the first beverage concentrate or second beverage concentrate to the other of the first or second mixing chamber creating the cold version of a corresponding beverage in response to the input being a selection of the cold version and one of the first dispense switch or second dispense switch being actuated at the same time as the other beverage; and

wherein the at least one flow controller is further configured to mechanically adjust at least one orifice size to control the ratio of the beverage concentrate to the water supplied to the mixing chambers by adjusting a location of a piston relative to a sleeve.

2. The apparatus of claim 1, further comprising a temperature controller configured to monitor a temperature of the hot water.

3. The apparatus of claim 2, wherein the temperature controller is configured to cause a heater element to turn on in response to detecting the temperature of the hot water is below a predetermined temperature.

4. The apparatus of claim 2, wherein the temperature controller is configured to cause a heater element to turn off in response to detecting the temperature of the hot water is above a predetermined temperature.

5. The apparatus of claim 1, further comprising a controller configured to:

determine a first flow rate of the hot water or the cold water and a second flow rate of the beverage concentrate; and

adjust the first flow rate or the second flow rate to maintain the controlled ratio.

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6. An apparatus comprising:

a plurality of hot water valves configured to control supplying of hot water from a heater tank configured to store hot water, the heater tank comprising a liquid level control unit configured to monitor a level of the hot water in the heater tank and to cause input of water into the heater tank in response to the level falling below a predetermined level;

a plurality of cold water valves configured to control supplying of cold water;

a plurality of dispenser switches each configured to cause dispensing of one of a plurality of beverages;

a temperature indicating selector switch configured to receive input selecting a hot version or a cold version of a beverage to be dispensed in response to a dispenser switch being actuated, the temperature indicating selector switch further configured to indicate between the hot or cold selection;

a plurality of pumps each coupled to a separate respective concentrate container storing a beverage concentrate;

a flow controller configured to monitor a first flow rate of beverage concentrate supplied by a first of the pumps and a second flow rate of the hot water or the cold water to control a water to beverage concentrate ratio supplied to a mixing chamber;

wherein the flow controller is further configured to mechanically adjust at least one orifice size to control the water to beverage concentrate ratio supplied to the mixing chamber by adjusting a location of a piston relative to a sleeve, and wherein the apparatus is configured to dispense a first beverage including a first beverage concentrate at a same time as dispensing a second beverage at a different temperature and including a second beverage concentrate different from the first beverage concentrate.

7. The apparatus of claim 6, further comprising a temperature controller configured to monitor a temperature of the hot water.

8. The apparatus of claim 7, wherein the temperature controller is configured to cause a heating element to turn on in response to detecting that the temperature of the hot water is below a predetermined temperature.

9. The apparatus of claim 6, wherein the mixing chamber is one of a plurality of mixing chambers.

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